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<p>(54) Title: NOVEL COMPOUNDS</p> <p>(57) Abstract</p> <p>The invention relates to novel compounds having pharmacological activity, processes for their preparation, to compositions containing them and to their use in the treatment of CNS disorders.</p>		

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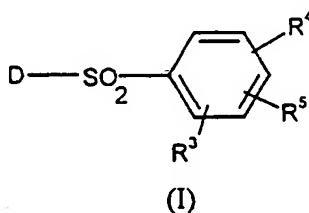
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## NOVEL COMPOUNDS

This invention relates to novel compounds having pharmacological activity, processes for their preparation, to compositions containing them and to their use in the treatment of CNS disorders.

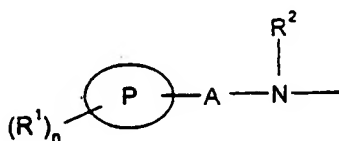
5 EPA 0 021 580 and EPA 0 076 072 describe naphthyl sulphonamide derivatives which are disclosed as having antiarrhythmic activity. European patent application EP 0815861 discloses a series of aryl sulphonamide compounds that are said to possess 5HT<sub>6</sub> receptor activity and are useful in the treatment of various CNS disorders. A structurally distinct class of compounds has now been discovered, which  
10 also have been found to have 5HT<sub>6</sub> receptor antagonist activity.

The present invention therefore provides, in a first aspect, a compound of formula (I) or a salt thereof:



in which the group D is selected from a group of formula (A), (B) or (C) below:-

(A)



in which P is a monocyclic, bicyclic or tricyclic alicyclic ring containing up to 20 carbon atoms in the ring(s);

A is a single bond, a C<sub>1-6</sub>alkylene or a C<sub>2-6</sub>alkenylene group;

R<sup>1</sup> is halogen, C<sub>1-6</sub>alkyl optionally substituted by one or more fluorine atoms,

C<sub>3-6</sub>cycloalkyl, C<sub>1-6</sub>alkoxy, OCF<sub>3</sub>, hydroxy, hydroxyc<sub>1-6</sub>alkyl, hydroxyc<sub>1-6</sub>alkoxy, C<sub>1-6</sub>alkoxyc<sub>1-6</sub>alkoxy, C<sub>1-6</sub>alkanoyl, amino, alkylamino or dialkylamino.

SR<sup>11</sup> where R<sup>11</sup> is hydrogen or C<sub>1-6</sub>alkyl or R<sup>1</sup> is aryl,

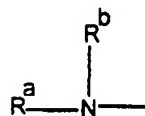
arylC<sub>1-6</sub>alkyl, a bicyclic heterocyclic ring or is a 5 to 7-membered

heterocyclic ring each containing 1 to 4 heteroatoms selected from oxygen, nitrogen or sulphur;

n is 0, 1, 2 or 3; and

R<sup>2</sup> is hydrogen, C<sub>1-6</sub>alkyl, aryl, arylC<sub>1-6</sub>alkyl or C<sub>3-6</sub>cycloalkyl; or

(B)



in which R<sup>a</sup> is an alkyl group containing 1 to 20 carbon atoms or is an arylC<sub>1-6</sub>alkyl group, and R<sup>b</sup> is hydrogen or C<sub>1-6</sub>alkyl;

(C)



in which Q is a mono-, bi- or tricyclic group containing a nitrogen heteroatom bonded to the adjacent SO<sub>2</sub> group or Q is a 5-7 membered heterocyclic ring containing a nitrogen heteroatom bonded to the adjacent SO<sub>2</sub> group and a further heteroatom selected from nitrogen, oxygen or sulphur, and R<sup>1</sup> and n are as defined above;

- 20 R<sup>3</sup> is a group R<sup>5</sup> or together with R<sup>5</sup> forms a group (CH<sub>2</sub>)<sub>2</sub>O or (CH<sub>2</sub>)<sub>3</sub>O optionally substituted with 1 or more C<sub>1-6</sub>alkyl groups;  
 R<sup>4</sup> is an optionally substituted piperazine ring; and  
 R<sup>5</sup> is hydrogen, halogen, C<sub>1-6</sub>alkyl, C<sub>3-6</sub>cycloalkyl, C<sub>1-6</sub>alkoxy optionally substituted with one or more fluorine atoms, hydroxy, hydroxyC<sub>1-6</sub>alkyl, hydroxyC<sub>1-6</sub>alkoxy, C<sub>1-6</sub>alkoxyC<sub>1-6</sub>alkoxy, C<sub>1-6</sub>alkanoyl, trifluoromethyl, or aryl.

Alkyl groups, whether alone or as part of another group, may be straight chain or branched. The term 'halogen' is used herein to describe, unless otherwise stated, a group selected from fluorine, chlorine, bromine or iodine. The term 'aryl' is used herein to describe, unless otherwise stated, a group such as phenyl or naphthyl. Such aryl groups may be optionally substituted by one or more C<sub>1-6</sub>alkyl or halogen.

**Within the definition of group D formula (A):**

The group P may be saturated or unsaturated and includes bridged and unbridged bicyclic or tricyclic alicyclic rings, containing saturated and/or unsaturated

rings. Examples of the group P which contain both a saturated and an unsaturated ring include indanyl and tetrahydronaphthyl. With such examples the group A is attached to the group P via a carbon atom of the unsaturated ring. When P is a monocyclic ring, suitable examples include cycloalkyl groups containing 4 to 10 carbon atoms e.g. cyclopentyl, cyclohexyl or cycloheptyl. Bicyclic and tricyclic rings may contain, for example, 10 to 20 carbon atoms. Examples of bridged bicyclic groups include bicyclo[2.2.1]heptyl or born-2-yl and examples of bridged tricyclic groups include adamantyl. Preferably P is cyclohexyl.

When  $R^1$  is a bicyclic heterocyclic ring, suitable examples include benzothiophene, indole, benzimidazole, quinoline or isoquinoline. Suitable 5 to 7-membered heterocyclic rings include thienyl, furyl, pyrrolyl, triazolyl, imidazolyl, oxazolyl, thiazolyl, oxadiazolyl, isothiazolyl, isoxazolyl, thiadiazolyl, pyridyl, pyrimidyl, pyrrolidinyl and pyrazinyl. The heterocyclic rings can be linked to the remainder of the molecule via any suitable carbon atom or, when present, a nitrogen atom. Preferably  $R^1$  is a  $C_{1-6}$ alkyl group such as methyl or ethyl. Preferably n is 0, 1 or 2.

When  $R^2$  is a  $C_{3-6}$ cycloalkyl group a preferred example is cyclohexyl. Preferably  $R^2$  is hydrogen or a  $C_{1-6}$ alkyl group such as methyl, ethyl or isopropyl.

Suitably A is a single bond, a methylene or ethylene group or a  $-CH=CH-$  group. Preferably A is a single bond or methylene.

**Within the definition of group D formula (B):**

The alkyl group  $R^a$  may be straight chain or branched. Preferably  $R^a$  represents a  $C_{1-8}$ alkyl group.

Preferably  $R^b$  is hydrogen.

**Within the definition of group D formula (C):**

When Q is a mono-, bi- or tricyclic group containing a single nitrogen heteroatom, suitable examples may be saturated or unsaturated including partially unsaturated groups for example bicyclic groups in which one ring is saturated and the other is unsaturated. Monocyclic groups preferably contain 4 to 8 atoms in the ring, advantageously six atoms, a preferred example of such a monocyclic group being piperidine. Bicyclic groups, which may be bridged or unbridged, preferably contain 8 to 12 atoms in the rings, advantageously 10 atoms, preferred examples of such bicyclic groups being decahydroquinoline or decahydroisoquinoline. Tricyclic groups, which may be bridged or unbridged, preferably contain 6 to 14 atoms in the rings. When Q is a 5-7 membered heterocyclic ring containing a further heteroatom, suitable examples include piperazinyl, morpholinyl or thiomorpholinyl.

When R<sup>1</sup> is a bicyclic heterocyclic ring or a 5-7 membered heterocyclic ring suitable examples include those listed for R<sup>1</sup> within the definition of formula (A). Preferably R<sup>1</sup> is a C<sub>1-6</sub>alkyl group such as methyl or ethyl or an arylC<sub>1-6</sub>alkyl group such as benzyl. Preferably n is 0, 1 or 2.

5

R<sup>3</sup> is a group R<sup>5</sup> or together with R<sup>5</sup> forms a group (CH<sub>2</sub>)<sub>2</sub>O or (CH<sub>2</sub>)<sub>3</sub>O. It will be appreciated that when R<sup>3</sup>/R<sup>5</sup> groups are linked together the two groups must be attached to adjacent carbon atoms of the phenyl ring. Preferably R<sup>3</sup> is a group R<sup>5</sup>, in particular hydrogen.

10 Preferably R<sup>4</sup> is meta with respect to the SO<sub>2</sub> group. Optional substituents for the piperazine ring, which can be present on carbon and/or nitrogen atoms, include C<sub>1-6</sub>alkyl, in particular methyl. Most preferably R<sup>4</sup> is unsubstituted piperazine.

Suitably R<sup>5</sup> is C<sub>1-6</sub>alkoxy. Preferably R<sup>5</sup> is a methoxy group with a para relationship with respect to the SO<sub>2</sub> group.

15

Particular compounds of the invention include:

- N-Cyclohexyl-4-methoxy-3-piperazin-1-ylbenzenesulfonamide.
- N-Indan-1-yl-4-methoxy-3-piperazin-1-ylbenzenesulfonamide,
- N-Bicyclo[2.2.1]hept-2-yl-4-methoxy-3-piperazin-1-ylbenzenesulfonamide,
- 20 N-Adamantan-1-yl-4-methoxy-3-piperazin-1-ylbenzenesulfonamide,
- N-Cycloheptyl-4-methoxy-3-piperazin-1-ylbenzenesulfonamide,
- N-Cyclohexyl-4-methoxy-N-methyl-3-piperazin-1-ylbenzenesulfonamide.
- N-Adamantan-2-yl-4-methoxy-3-piperazin-1-ylbenzenesulfonamide,
- N-Cyclopentyl-4-methoxy-3-piperazin-1-ylbenzenesulfonamide,
- 25 1-[5-(4-Benzylpiperidine-1-sulfonyl)]-2-methoxyphenyl]piperazine,
- N-Hexyl-4-methoxy-3-piperazin-1-ylbenzenesulfonamide,
- N-Indan-2-yl-4-methoxy-3-piperazin-1-ylbenzenesulfonamide,
- 1-[5-(3,3-Dimethylpiperidine-1-sulfonyl)]-2-methoxyphenyl]piperazine.
- 1-[5-(2-Ethylpiperidine-1-sulfonyl)]-2-methoxyphenyl]piperazine.
- 30 4-Methoxy-N-(1-methylbutyl)-3-piperazin-1-ylbenzenesulfonamide,
- N-*tert*-Butyl-4-methoxy-3-piperazin-1-ylbenzenesulfonamide.
- (*R*)-4-Methoxy-3-piperazin-1-yl-N-(1,7,7-trimethylbicyclo[2.2.1]hept-2-yl)-benzenesulfonamide.
- N-(4-*tert*-Butylcyclohexyl)-4-methoxy-3-piperazin-1-ylbenzenesulfonamide.
- 35 4-Methoxy-N-(2-methylcyclohexyl)-3-piperazin-1-ylbenzenesulfonamide,
- 4-Methoxy-N-(3-methylcyclohexyl)-3-piperazin-1-ylbenzenesulfonamide,
- 4-Methoxy-N-(4-methylcyclohexyl)-3-piperazin-1-ylbenzenesulfonamide,
- N-(2,3-Dimethylcyclohexyl)-4-methoxy-3-piperazin-1-ylbenzenesulfonamide,

- 1-(4-Methoxy-3-piperazin-1-ylbenzenesulfonyl)decahydroquinoline.  
 2-(4-Methoxy-3-piperazin-1-ylbenzenesulfonyl)decahydroisoquinoline.  
*N*-[2-(4-Fluoro-phenyl)-1,1-dimethyl-ethyl]-4-methoxy-3-piperazin-1-yl-  
 benzenesulfonamide,  
 5 *N*-(1,1-Dimethyl-propyl)-4-methoxy-3-piperazin-1-yl-benzenesulfonamide.  
*N*-Cyclohexyl-4-methoxy-*N*-phenyl-3-piperazin-1-yl-benzenesulfonamide.  
*N,N*-Dicyclohexyl-4-methoxy-3-piperazin-1-yl-benzenesulfonamide.  
*N*-(1-(*R*)-Cyclohexyl-ethyl)-4-methoxy-3-piperazin-1-yl-benzenesulfonamide.  
*N*-(1-(*S*)-Cyclohexyl-ethyl)-4-methoxy-3-piperazin-1-yl-benzenesulfonamide ,  
 10 *N*-Cyclohexyl-*N*-ethyl-4-methoxy-3-piperazin-1-yl-benzenesulfonamide,  
*N*-Cyclohexyl-*N*-isopropyl-4-methoxy-3-piperazin-1-yl-benzenesulfonamide,  
 4-(4-Methoxy-3-piperazin-1-ylbenzenesulfonyl)morpholine,  
 4-(4-Methoxy-3-piperazin-1-ylbenzenesulfonyl)thiomorpholine,  
 4-Methoxy-3-piperazin-1-yl-*N*-(1,1,3,3-tetramethylbutyl)benzenesulfonamide  
 15 an pharmaceutically acceptable salts thereof.

The compounds of the formula (I) can form acid addition salts with acids, such as conventional pharmaceutically acceptable acids, for example maleic, hydrochloric, hydrobromic, phosphoric, acetic, fumaric, salicylic, citric, lactic, mandelic, tartaric and methanesulphonic.

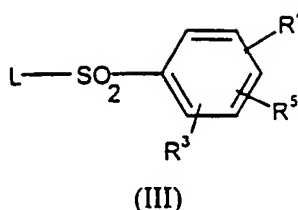
- 20 Compounds of formula (I) may also form solvates such as hydrates, and the invention also extends to these forms. When referred to herein, it is understood that the term 'compound of formula (I)' also includes these forms.

- Certain compounds of formula (I) are capable of existing in stereoisomeric forms including diastereomers and enantiomers and the invention extends to each of  
 25 these stereoisomeric forms and to mixtures thereof including racemates. The different stereoisomeric forms may be separated one from the other by the usual methods, or any given isomer may be obtained by stereospecific or asymmetric synthesis. The invention also extends to any tautomeric forms and mixtures thereof.

- The present invention also provides a process for the preparation of a  
 30 compound of formula (I) or a pharmaceutically acceptable salt thereof, which process comprises the coupling of a compound of formula (II):



- 35 in which D is as defined in formula (I) or protected derivatives thereof with a compound of formula (III):



in which  $R^3$ ,  $R^4$  and  $R^5$  are as defined in formula (I) or protected derivatives thereof  
 5 and L is a leaving group and optionally thereafter:

- removing any protecting groups,
- forming a pharmaceutically acceptable salt.

Suitable leaving groups include halogen, in particular chloro. The reaction of  
 a compounds of formulae (II) and (III) is carried out by mixing the two reagents  
 10 together, optionally in an inert solvent such as dichloromethane with or without the  
 addition of a suitable base such as triethylamine.

Those skilled in the art will appreciate that it may be necessary to protect  
 certain groups. Suitable protecting groups and methods for their attachment and  
 removal are conventional in the art of organic chemistry, such as those described in  
 15 Greene T.W. 'Protective groups in organic synthesis' New York, Wiley (1981).

Compounds of formulae (II) and (III) are commercially available or may be  
 prepared according to known methods or analogous to known methods.

Pharmaceutically acceptable salts may be prepared conventionally by  
 reaction with the appropriate acid or acid derivative.

20 Compounds of formula (I) and their pharmaceutically acceptable salts have  
 5HT<sub>6</sub> receptor antagonist activity and are believed to be of potential use in the  
 treatment of certain CNS disorders such as anxiety, depression, epilepsy, obsessive  
 compulsive disorders, migraine, cognitive memory disorders e.g. Alzheimers disease,  
 Parkinson' Disease, ADHD (Attention Deficit Disorder/Hyperactivity Syndrome),  
 25 sleep disorders (including disturbances of Circadian rhythm), feeding disorders such  
 as anorexia and bulimia, panic attacks, withdrawal from drug abuse such as cocaine,  
 ethanol, nicotine and benzodiazepines, schizophrenia, and also disorders associated  
 with spinal trauma and/or head injury such as hydrocephalus. Compounds of the  
 invention are also expected to be of use in the treatment of certain GI  
 30 (gastrointestinal) disorders such as IBS (Irritable Bowel Syndrome).

Thus the invention also provides a compound of formula (I) or a  
 pharmaceutically acceptable salt thereof, for use as a therapeutic substance, in  
 particular in the treatment or prophylaxis of the above disorders.

The invention further provides a method of treatment or prophylaxis of the  
 35 above disorders, in mammals including humans, which comprises administering to the



sufferer a therapeutically effective amount of a compound of formula (I) or a pharmaceutically acceptable salt thereof.

In another aspect, the invention provides the use of a compound of formula (I) or a pharmaceutically acceptable salt thereof in the manufacture of a medicament  
5 for the treatment or prophylaxis of the above disorders.

The present invention also provides a pharmaceutical composition, which comprises a compound of formula (I) or a pharmaceutically acceptable salt thereof, and a pharmaceutically acceptable carrier.

A pharmaceutical composition of the invention, which may be prepared by  
10 admixture, suitably at ambient temperature and atmospheric pressure, is usually adapted for oral, parenteral or rectal administration and, as such, may be in the form of tablets, capsules, oral liquid preparations, powders, granules, lozenges, reconstitutable powders, injectable or infusable solutions or suspensions or suppositories. Orally administrable compositions are generally preferred.

15 Tablets and capsules for oral administration may be in unit dose form, and may contain conventional excipients, such as binding agents, fillers, tableting lubricants, disintegrants and acceptable wetting agents. The tablets may be coated according to methods well known in normal pharmaceutical practice.

Oral liquid preparations may be in the form of, for example, aqueous or oily  
20 suspension, solutions, emulsions, syrups or elixirs, or may be in the form of a dry product for reconstitution with water or other suitable vehicle before use. Such liquid preparations may contain conventional additives such as suspending agents, emulsifying agents, non-aqueous vehicles (which may include edible oils), preservatives, and, if desired, conventional flavourings or colourants.

25 For parenteral administration, fluid unit dosage forms are prepared utilising a compound of the invention or pharmaceutically acceptable salt thereof and a sterile vehicle. The compound, depending on the vehicle and concentration used, can be either suspended or dissolved in the vehicle. In preparing solutions, the compound can be dissolved for injection and filter sterilised before filling into a suitable vial or  
30 ampoule and sealing. Advantageously, adjuvants such as a local anaesthetic, preservatives and buffering agents are dissolved in the vehicle. To enhance the stability, the composition can be frozen after filling into the vial and the water removed under vacuum. Parenteral suspensions are prepared in substantially the same manner, except that the compound is suspended in the vehicle instead of being  
35 dissolved, and sterilization cannot be accomplished by filtration. The compound can be sterilised by exposure to ethylene oxide before suspension in a sterile vehicle. Advantageously, a surfactant or wetting agent is included in the composition to facilitate uniform distribution of the compound.

The composition may contain from 0.1% to 99% by weight, preferably from 10 to 60% by weight, of the active material, depending on the method of administration.

The dose of the compound used in the treatment of the aforementioned disorders will vary in the usual way with the seriousness of the disorders, the weight of the sufferer, and other similar factors. However, as a general guide suitable unit doses may be 0.05 to 1000 mg, more suitably 0.05 to 20.0 mg, for example 0.2 to 5 mg; and such unit doses may be administered more than once a day, for example two or three a day, so that the total daily dosage is in the range of about 0.5 to 100 mg; and such therapy may extend for a number of weeks or months.

When administered in accordance with the invention, no unacceptable toxicological effects are expected with the compounds of the invention.

The following Descriptions and Examples illustrate the preparation of compounds of the invention.

15

#### **Description 1**

##### **2-(4-Trichloroacetylpiperazin-1-yl) anisole (D1)**

A solution of 1-(2-methoxyphenyl) piperazine (7.0g) in dichloromethane (30ml) was added over 15 minutes to a stirred solution of trichloroacetyl chloride (4.06ml) in dichloromethane (40ml) at room temperature under argon. Diisopropylethylamine (5.95ml) was then added and the whole was stirred for 18 hours. The reaction mixture was washed with water (2 x 100ml), dried ( $\text{Na}_2\text{SO}_4$ ) and concentrated to give the title compound (D1) as an oil (11.2g, 91%),  $\text{MH}^+$  337/339.

#### **Description 2**

##### **3-(4-Trichloroacetylpiperazin-1-yl)-4-methoxybenzenesulfonyl chloride (D2)**

A solution of 2-(4-trichloroacetylpiperazin-1-yl) anisole (D1) (10g) in dichloromethane (115ml) was added over 0.3h to ice-cooled chlorosulfonic acid (52ml). After 0.5h at  $0^\circ\text{C}$  then 1 hour at ambient temperature, the solution was poured onto a mixture of ice-water (500g) and dichloromethane (500ml) with rapid stirring. The layers were separated and the organic phase was washed with water (2 x 800ml), dried ( $\text{MgSO}_4$ ) and concentrated to give the title compound (D2) as a foam (6.0g, 46%),  $\text{MH}^+$  435/437.

35

#### **Example 1**

##### **N-Cyclohexyl-4-methoxy-3-piperazin-1-ylbenzenesulfonamide hydrochloride (E1)**

A solution of cyclohexylamine (91mg) in dichloromethane (1ml) was added slowly to a stirred solution of 3-(4-trichloroacetyl)piperazin-1-yl)-4-methoxybenzenesulfonyl chloride (D2) (200mg) in dichloromethane (2ml). The mixture was stirred overnight then washed with 1M HCl (4ml) and water (4ml), dried and concentrated to a solid.

- 5 The solid was dissolved in tetrahydrofuran or 1,4-dioxane (5ml) and to the solution was added 0.15M potassium hydroxide solution (5ml) and the whole stirred at ambient temperature for 8 hours. The solution was concentrated to remove the organic solvent and the aqueous residue was extracted with dichloromethane (2 x 20ml). The combined extracts were dried, acidified with 1M ethereal hydrogen  
10 chloride (1ml), concentrated to an oil and stirred with acetone/diethyl ether to afford the title compound (E1) (28mg, 21%).  $\delta$ H (250MHz, d6-DMSO) 1.10 (5H, br, s), 1.56 (5H, br, s), 2.86 (1H, br, s), 3.21 (8H, br, s), 3.87 (3H, s), 7.13 (1H, d, J = 8.0 Hz), 7.33 (1H, s), 7.46-7.52 (2H, m), 9.19 (2H, br, s).  $MH^+$  354.

#### 15 Example 2

##### **N-Indan-1-yl-4-methoxy-3-piperazin-1-ylbenzenesulfonamide hydrochloride (E2)**

- To a stirred solution of 3-(4-trichloroacetyl)piperazin-1-yl)-4-methoxybenzenesulfonyl chloride (0.46 mmol) in dichloromethane (2 ml) was added a solution of amine (1 mmol) in dichloromethane (1ml). The mixture was stirred at ambient temperature  
20 overnight, then dichloromethane (4 ml) was added and the resulting solution was washed with 1M HCl (4ml) and water (4ml), dried ( $Na_2SO_4$ ) and concentrated to a solid. The solid was dissolved in 1,4-dioxane (9 ml) or 1,4-dioxane:tetrahydrofuran (5:4, v/v, 9ml), 1M aqueous potassium hydroxide (1ml) was added and the reaction was stirred at ambient temperature for 17 hours. The solvent was partially removed,  
25 water was added (5 ml) and the solution was extracted with dichloromethane (2 x 10ml). The combined extracts were dried ( $Na_2SO_4$ ) and evaporated to dryness. The residue was redissolved in dichloromethane (2ml), acidified with 1M hydrogen chloride in diethyl ether (1ml) and concentrated to afford the title compound as a solid (E2) (177 mg, 91%),  $MH^+$  388.

30

The following compounds were prepared by a similar method to that described in Example 2 using the appropriate amine. All amines are either commercially available or can be prepared according to literature procedures.

Compound	$MH^+$
<b>N-Bicyclo[2.2.1]hept-2-yl-4-methoxy-3-piperazin-1-ylbenzenesulfonamide (E3)</b>	366

N-Adamantan-1-yl-4-methoxy-3-piperazin-1-ylbenzenesulfonamide (E4)	406
N-Cycloheptyl-4-methoxy-3-piperazin-1-ylbenzenesulfonamide (E5)	368
N-Cyclohexyl-4-methoxy-N-methyl-3-piperazin-1-ylbenzenesulfonamide (E6)	368
N-Adamantan-2-yl-4-methoxy-3-piperazin-1-ylbenzenesulfonamide (E7)	406
N-Cyclopentyl-4-methoxy-3-piperazin-1-ylbenzenesulfonamide (E8)	340
1-[5-(4-Benzylpiperidine-1-sulfonyl)]-2-methoxyphenyl]piperazine (E9)	430
N-Hexyl-4-methoxy-3-piperazin-1-ylbenzenesulfonamide (E10)	356
N-Indan-2-yl-4-methoxy-3-piperazin-1-ylbenzenesulfonamide (E11)	388
1-[5-(3,3-Dimethylpiperidine-1-sulfonyl)]-2-methoxyphenyl]piperazine (E12)	368
1-[5-(2-Ethylpiperidine-1-sulfonyl)]-2-methoxyphenyl]piperazine (E13)	368
4-Methoxy-N-(1-methylbutyl)-3-piperazin-1-ylbenzenesulfonamide (E14)	342
N-tert-Butyl-4-methoxy-3-piperazin-1-ylbenzenesulfonamide (E15)	328
(R)-4-Methoxy-3-piperazin-1-yl-N-(1,7,7-trimethylbicyclo[2.2.1]hept-2-yl)-benzenesulfonamide (E16)	408
N-(4-tert-Butylcyclohexyl)-4-methoxy-3-piperazin-1-ylbenzenesulfonamide (E17)	410
4-Methoxy-N-(2-methylcyclohexyl)-3-piperazin-1-ylbenzenesulfonamide (E18)	368
4-Methoxy-N-(3-methylcyclohexyl)-3-piperazin-1-ylbenzenesulfonamide (E19)	368
4-Methoxy-N-(4-methylcyclohexyl)-3-piperazin-1-ylbenzenesulfonamide (E20)	368
N-(2,3-Dimethylcyclohexyl)-4-methoxy-3-piperazin-1-ylbenzenesulfonamide (E21)	382
1-(4-Methoxy-3-piperazin-1-ylbenzenesulfonyl)decahydroquinoline (E22)	394

2-(4-Methoxy-3-piperazin-1-ylbenzenesulfonyl)decahydroisoquinoline (E23)	394
<i>N</i> -[2-(4-Fluoro-phenyl)-1,1-dimethyl-ethyl]-4-methoxy-3-piperazin-1-yl-benzenesulfonamide (E24)	422
<i>N</i> -(1,1-Dimethyl-propyl)-4-methoxy-3-piperazin-1-yl-benzenesulfonamide (E25)	342
<i>N</i> -Cyclohexyl-4-methoxy- <i>N</i> -phenyl-3-piperazin-1-yl-benzenesulfonamide (E26)	430
<i>N,N</i> -Dicyclohexyl-4-methoxy-3-piperazin-1-yl-benzenesulfonamide (E27)	436
<i>N</i> -(1-( <i>R</i> )-Cyclohexyl-ethyl)-4-methoxy-3-piperazin-1-yl-benzenesulfonamide (E28)	382
<i>N</i> -(1-( <i>S</i> )-Cyclohexyl-ethyl)-4-methoxy-3-piperazin-1-yl-benzenesulfonamide (E29)	382
<i>N</i> -Cyclohexyl- <i>N</i> -ethyl-4-methoxy-3-piperazin-1-yl-benzenesulfonamide (E30)	382
<i>N</i> -Cyclohexyl- <i>N</i> -isopropyl-4-methoxy-3-piperazin-1-yl-benzenesulfonamide (E31)	396
4-(4-Methoxy-3-piperazin-1-ylbenzenesulfonyl)morpholine (E32)	342
4-(4-Methoxy-3-piperazin-1-ylbenzenesulfonyl)thiomorpholine (E33)	358
4-Methoxy-3-piperazin-1-yl- <i>N</i> -(1,1,3,3-tetramethylbutyl)benzenesulfonamide (E34)	384

#### Pharmacological data

5

Compounds can be tested following the procedures outlined in WO 98/27081.

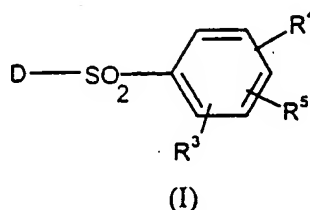
All compounds tested showed good affinity for the 5-HT<sub>6</sub> receptor, having pK<sub>i</sub> values 7.4-8.8 at human cloned 5-HT<sub>6</sub> receptors. Particularly preferred compounds demonstrated pK<sub>i</sub> > 7.9 and >100 fold selectivity. Examples of such compounds

10 include:

E1, E3-7, E17-22, E27, E30-31.

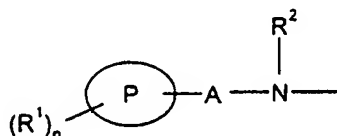
## Claims:

1. A compound of formula (I) or a salt thereof:



in which the group D is selected from a group of formula (A), (B) or (C) below:-

10 (A)



15 in which P is a monocyclic, bicyclic or tricyclic alicyclic ring containing up to 20 carbon atoms in the ring(s);

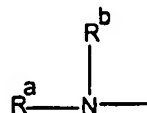
A is a single bond, a C<sub>1-6</sub>alkylene or a C<sub>2-6</sub>alkenylene group;

R<sup>1</sup> is halogen, C<sub>1-6</sub>alkyl optionally substituted by one or more fluorine atoms, C<sub>3-6</sub>cycloalkyl, C<sub>1-6</sub>alkoxy, OCF<sub>3</sub>, hydroxy, hydroxyC<sub>1-6</sub>alkyl, hydroxyC<sub>1-6</sub>alkoxy, C<sub>1-6</sub>alkoxyC<sub>1-6</sub>alkoxy, C<sub>1-6</sub>alkanoyl, amino, alkylamino or dialkylamino, SR<sup>11</sup> where R<sup>11</sup> is hydrogen or C<sub>1-6</sub>alkyl or R<sup>1</sup> is aryl, arylC<sub>1-6</sub>alkyl, a bicyclic heterocyclic ring or is a 5 to 7-membered heterocyclic ring each containing 1 to 4 heteroatoms selected from oxygen, nitrogen or sulphur;

25 n is 0, 1, 2 or 3; and

R<sup>2</sup> is hydrogen, C<sub>1-6</sub>alkyl, aryl, arylC<sub>1-6</sub>alkyl or C<sub>3-6</sub>cycloalkyl; or

(B)



in which  $R^a$  is an alkyl group containing 1 to 20 carbon atoms or is an aryl  $C_{1-6}$ alkyl group, and  $R^b$  is hydrogen or  $C_{1-6}$ alkyl;

(C)

5



10

in which Q is a mono-, bi- or tricyclic group containing a nitrogen heteroatom bonded to the adjacent  $SO_2$  group or Q is a 5-7 membered heterocyclic ring containing a nitrogen heteroatom bonded to the adjacent  $SO_2$  group and a further heteroatom selected from nitrogen, oxygen or sulphur, and  $R^1$  and n are as defined above;

15

$R^3$  is a group  $R^5$  or together with  $R^5$  forms a group  $(CH_2)_2O$  or  $(CH_2)_3O$  optionally substituted with 1 or more  $C_{1-6}$ alkyl groups;

$R^4$  is an optionally substituted piperazine ring;

$R^5$  is hydrogen, halogen,  $C_{1-6}$ alkyl,  $C_{3-6}$ cycloalkyl,  $C_{1-6}$ alkoxy optionally substituted with one or more fluorine atoms, hydroxy, hydroxy  $C_{1-6}$ alkyl, hydroxy  $C_{1-6}$ alkoxy,  $C_{1-6}$ alkoxy  $C_{1-6}$ alkoxy,  $C_{1-6}$ alkanoyl, trifluoromethyl or aryl.

20

2. A compound according to claim 1 in which P is cyclohexyl.

3. A compound according to claim 1 in which Q is piperidine.

25

4. A compound according to any one of claims 1 to 3 in which  $R^1$  is  $C_{1-6}$ alkyl.

30

5. A compound according to any one of claims 1 to 4 in which  $R^4$  is an unsubstituted piperazine ring.

6. A compound according to any one of claims 1 to 5 in which  $R^5$  is methoxy.

7. A compound according to claim 1 which is:

35 N-Cyclohexyl-4-methoxy-3-piperazin-1-ylbenzenesulfonamide.

N-Indan-1-yl-4-methoxy-3-piperazin-1-ylbenzenesulfonamide.

N-Bicyclo[2.2.1]hept-2-yl-4-methoxy-3-piperazin-1-ylbenzenesulfonamide,

- N-Adamantan-1-yl-4-methoxy-3-piperazin-1-ylbenzenesulfonamide,  
 N-Cycloheptyl-4-methoxy-3-piperazin-1-ylbenzenesulfonamide,  
 N-Cyclohexyl-4-methoxy-N-methyl-3-piperazin-1-ylbenzenesulfonamide,  
 N-Adamantan-2-yl-4-methoxy-3-piperazin-1-ylbenzenesulfonamide,  
 5 N-Cyclopentyl-4-methoxy-3-piperazin-1-ylbenzenesulfonamide,  
 1-[5-(4-Benzylpiperidine-1-sulfonyl)]-2-methoxyphenyl]piperazine,  
 N-Hexyl-4-methoxy-3-piperazin-1-ylbenzenesulfonamide,  
 N-Indan-2-yl-4-methoxy-3-piperazin-1-ylbenzenesulfonamide,  
 1-[5-(3,3-Dimethylpiperidine-1-sulfonyl)]-2-methoxyphenyl]piperazine,  
 10 1-[5-(2-Ethylpiperidine-1-sulfonyl)]-2-methoxyphenyl]piperazine,  
 4-Methoxy-N-(1-methylbutyl)-3-piperazin-1-ylbenzenesulfonamide,  
 N-*tert*-Butyl-4-methoxy-3-piperazin-1-ylbenzenesulfonamide,  
 (*R*)-4-Methoxy-3-piperazin-1-yl-N-(1,7,7-trimethylbicyclo[2.2.1]hept-2-yl)-  
 benzenesulfonamide,  
 15 N-(4-*tert*-Butylcyclohexyl)-4-methoxy-3-piperazin-1-ylbenzenesulfonamide,  
 4-Methoxy-N-(2-methylcyclohexyl)-3-piperazin-1-ylbenzenesulfonamide,  
 4-Methoxy-N-(3-methylcyclohexyl)-3-piperazin-1-ylbenzenesulfonamide,  
 4-Methoxy-N-(4-methylcyclohexyl)-3-piperazin-1-ylbenzenesulfonamide,  
 N-(2,3-Dimethylcyclohexyl)-4-methoxy-3-piperazin-1-ylbenzenesulfonamide,  
 20 1-(4-Methoxy-3-piperazin-1-ylbenzenesulfonyl)decahydroquinoline,  
 2-(4-Methoxy-3-piperazin-1-ylbenzenesulfonyl)decahydroisoquinoline,  
 N-[2-(4-Fluoro-phenyl)-1,1-dimethyl-ethyl]-4-methoxy-3-piperazin-1-yl-  
 benzenesulfonamide,  
 N-(1,1-Dimethyl-propyl)-4-methoxy-3-piperazin-1-yl-benzenesulfonamide,  
 25 N-Cyclohexyl-4-methoxy-N-phenyl-3-piperazin-1-yl-benzenesulfonamide,  
 N,N-Dicyclohexyl-4-methoxy-3-piperazin-1-yl-benzenesulfonamide,  
 N-(1-(*R*)-Cyclohexyl-ethyl)-4-methoxy-3-piperazin-1-yl-benzenesulfonamide,  
 N-(1-(*S*)-Cyclohexyl-ethyl)-4-methoxy-3-piperazin-1-yl-benzenesulfonamide,  
 N-Cyclohexyl-N-ethyl-4-methoxy-3-piperazin-1-yl-benzenesulfonamide,  
 30 N-Cyclohexyl-N-isopropyl-4-methoxy-3-piperazin-1-yl-benzenesulfonamide  
 4-(4-Methoxy-3-piperazin-1-ylbenzenesulfonyl)morpholine,  
 4-(4-Methoxy-3-piperazin-1-ylbenzenesulfonyl)thiomorpholine,  
 4-Methoxy-3-piperazin-1-yl-N-(1,1,3,3-tetramethylbutyl)benzenesulfonamide  
 and pharmaceutically acceptable salts thereof.

35

8. A compound according to any one of claims 1 to 7 for use in therapy.



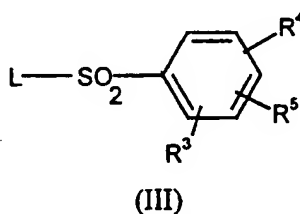
9. A compound according to any one of claims 1 to 7 for use in the treatment of Alzheimers disease, Parkinson's Disease, schizophrenia and/or depression.

5 10. A pharmaceutical composition which comprises a compound according to any one of claims 1 to 7 and a pharmaceutically acceptable carrier or excipient.

11. A process for the preparation of a compound of formula (I) or a pharmaceutically acceptable salt thereof, which process comprises the coupling of a  
10 compound of formula (II):



in which D is as defined in formula (I) or protected derivatives thereof with a  
15 compound of formula (III):



20 in which  $\text{R}^3$ ,  $\text{R}^4$  and  $\text{R}^5$  are as defined in formula (I) or protected derivatives thereof and L is a leaving group and optionally thereafter

- removing any protecting groups;
- forming a pharmaceutically acceptable salt.

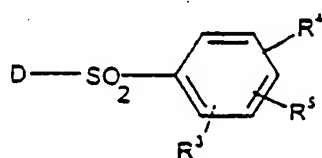
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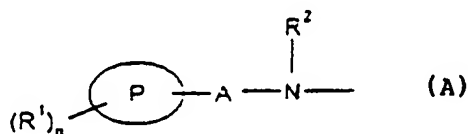
## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(30) Priority Data: 9801392.3      22 January 1998 (22.01.98)      GB		Published With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.	
(71) Applicant (for all designated States except US): SMITHKLINE BEECHAM PLC [GB/GB]; New Horizons Court, Brentford, Middlesex TW8 9EP (GB).		(88) Date of publication of the international search report: 21 October 1999 (21.10.99)	
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(74) Agent: WATERS, David, Martin; SmithKline Beecham, Two New Horizons Court, Brentford, Middlesex TW8 9EP (GB).			

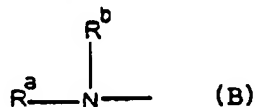
(54) Title: SULPHONAMIDE DERIVATIVES FOR TREATMENT OF CNS DISORDERS



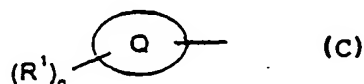
(I)



(A)



(B)



(C)

## (57) Abstract

The invention relates to novel compounds of formula (I) or a salt thereof: in which the group D is selected from a group of formula (A), (B) or (C). Compounds of formula (I) and their pharmaceutically acceptable salts have 5HT<sub>6</sub> receptor antagonist activity and are believed to be of potential use in the treatment of certain CNS disorders such as anxiety, depression, epilepsy, obsessive compulsive disorders, migraine, cognitive memory disorders e.g. Alzheimers disease, Parkinson' Disease, ADHD (Attention Deficit Disorder/Hyperactivity Syndrome), sleep disorders (including disturbances of Circadian rhythm), feeding disorders such as anorexia and bulimia, panic attacks, withdrawal from drug abuse such as cocaine, ethanol, nicotine and benzodiazepines, schizophrenia, and also disorders associated with spinal trauma and/or head injury such as hydrocephalus. Compounds of the invention are also expected to be of use in the treatment of certain GI (gastrointestinal) disorders such as IBS (Irritable Bowel Syndrome).

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# INTERNATIONAL SEARCH REPORT

national Application No  
PCT/EP 99/00262

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 C07D295/096 A61K31/495 A61K31/50 C07D215/58 C07D217/08

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 A61K C07D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 244 115 A (PFIZER LTD.) 4 November 1987 (1987-11-04) example 13	1, 10
X	DE 34 11 993 A (BAYER AG) 10 October 1985 (1985-10-10) example 25	1, 10
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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19 August 1999

Date of mailing of the international search report

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Authorized officer

Van Bijlen, H

# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/EP 99/00262

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	BE 620 236 A (MAY & BAKER LTD.) 14 January 1963 (1963-01-14) examples 1,2 ----	1,10
X	G. RÉGNIER ET AL.: "Etude chimique et pharmacologique de nouveaux dérivés de la nor-adrenaline" ARZNEIMITTEL FORSCHUNG. DRUG RESEARCH., vol. 19, no. 10, - 1969 pages 1698-1702, XP002112727 EDITIO CANTOR. AULENDORF., DE ISSN: 0004-4172 * page 1698, right column: compound A); examples 15 and 31 * ----	1,10
X	EP 0 675 118 A (EISAI CO., LTD.) 4 October 1995 (1995-10-04) examples 123,134,135,141,154,161 ----	1,10
A	EP 0 815 861 A (F. HOFFMANN-LA ROCHE AG) 7 January 1998 (1998-01-07) cited in the application page 3, line 50 - page 4, line 1; claims -----	1,10

# INTERNATIONAL SEARCH REPORT

international application No.

PCT/EP 99/00262

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☒ Claims Nos.: 8-9  
because they relate to subject matter not required to be searched by this Authority, namely:  
Remark: Although claims 8 and 9 are directed to a method of treatment of the human/animal body, the search has been carried out and based on the alleged effects of the compound/composition.
2. ☐ Claims Nos.:  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

# INTERNATIONAL SEARCH REPORT

Information on patent family members

national Application No

PCT/EP 99/00262

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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